Anton Paar

Instruction Manual and Safety Information

Modular Compact Rheometer

MCR 53, MCR 73, MCR 93, SmartMelt 73, SmartPave 93

Published and printed by Anton Paar

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Date: January 2026
Document number: J52IB001EN-A
Original instructions

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1 Safety Instructions

Read the documentation

- Read the documentation before using the product.
- Follow all hints and instructions in the documentation to ensure the correct use and safe functioning of the product.

General

- The documentation is a part of the product. Keep it for the complete working life of the product and make it easily accessible to all persons involved with the product. If you receive any additions or revisions from Anton Paar, these must be treated as part of the documentation.

Liability

- This document does not claim to address all safety issues associated with the use of the product and samples. It is your responsibility to establish health and safety practices and to determine the applicability of regulatory limitations.
- Anton Paar only warrants the safe and proper functioning of the product if no modifications are made to mechanics, electronics, or software.
- Use the product only for the purpose described in the documentation. Anton Paar is not liable for damages caused by incorrect use of the product.
- The results delivered by the product depend on the correct function of the product and various other factors. We recommend that you have experts check the results (i.e., perform plausibility testing) before taking consequential actions based on the results.
- The proper function of the instrument's protective devices is only guaranteed when operated correctly within the specified scope of applications.

General precautions

- Observe and adhere to your national safety regulations regarding the handling of all substances associated with your measurements (e.g. use safety goggles, gloves, respiratory protection, etc.).
- Substances used must be labeled. The corresponding material safety data sheets must be observed and made available near the measuring setup.
- Samples and cleaning liquids that have been used in the measuring system are not suited for human consumption after use.
- Check the wetted parts of the product for chemical resistance to all samples and cleaning liquids.
- Take care that samples, cleaning liquids and gases are chemically compatible when they come into contact with each other. They must not react exothermally or produce hazardous substances.

Installation

- Never use the product outside the specified ambient conditions and specifications.
- Use only accessories, consumables, or spare parts supplied or approved by Anton Paar.
- Do not expose the product to direct sunlight for extended periods of time.

Using the product

- Ensure that all operators have been trained beforehand to use the product safely and correctly.
- Ensure that the product is sufficiently supervised during operation.
- In case of damage or malfunction, stop operating the product. Do not operate the product under conditions that could result in damage to goods or injuries or loss of life.
- If you suspect that spilled substances got into the product, disconnect the product from the electrical supply and have it checked for electrical safety by a service technician authorized by Anton Paar.
- If compressed gas from a gas bottle is used to operate the product, ensure that the operator is properly trained in the use of compressed gas bottles, and that all safety instructions of the gas bottle supplier are adhered to.

Operator´s skills

- All personnel involved in the operation and/or maintenance of the product must be qualified or properly instructed in its use.
- Operators must be able to read and understand the instructions within the manual.
- It is the owner's responsibility that all operators are sufficiently trained in the correct and safe use of the product.
- Operators must be able to judge dangerous situations and take the right measures to prevent accidents, injury and damage.

Precautions for flammable samples and cleaning agents

- Keep potential sources of ignition, like sparks or open flames, at a safe distance from the product.
- Store only the minimum required amount of sample, cleaning liquids, and other hazardous materials near the product.
- Do not spill sample/cleaning liquids or leave their containers uncovered. Immediately remove spilled sample/cleaning liquids.
- Ensure that the setup location is sufficiently ventilated. The environment of the product must be kept free from flammable gases and vapors.
- Provide fire-extinguishing equipment.

Operation in areas with risk of explosion

– The product is **not** explosion-proof and therefore must not be operated in areas with risk of explosion.

Service and repairs

– Service and repair procedures may be carried out only by authorized persons or by Anton Paar.

Disposal

– Concerning the disposal of the product, observe the legal requirements in your country. Contact your Anton Paar representative for further questions.

1.1 Conventions of Safety Messages

Conventions for safety messages

The following conventions for safety messages are used in this document:

DANGER

Description of risk

Danger indicates a hazardous situation which, if not avoided, **will** result in death or serious injury.

WARNING

Description of risk

Warning indicates a hazardous situation which, if not avoided, **could** result in death or serious injury.

CAUTION

Description of risk

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Description of risk

Notice indicates a situation which, if not avoided, could result in damage to property.

TIP: *Tip gives extra information about the situation at hand.*

Wear safety gloves

Wear protective gloves when handling the product.

Wear safety goggles

Wear safety goggles when handling the product.

Wear ear protection

Wear ear protection when handling the product.

Use protective clothing

Wear protective clothing when handling the product.

1.2 Safety Signs on the Instrument

There are three warning symbols on the MCR. All three are on the front of the main girder, two at the bottom and one at the top.

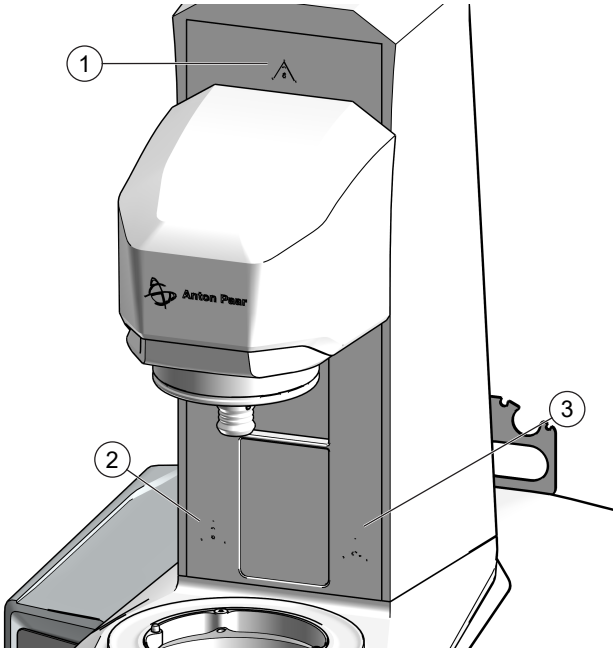


Fig. 1: *Position of warning symbols on the instrument*

1 CAUTION - General risk
2 CAUTION - General risk
3 CAUTION - Moving parts

CAUTION

General risk

There is a general risk in the area marked with this symbol. Carefully read the documentation and observe all safety notes.

CAUTION

Danger of hand injuries

In areas marked with this sign there is the possibility of hand or finger injuries through moving parts. Keep a safe distance as long as parts of the instrument are still in motion.

NOTICE

It is imperative that the warning symbols remain clearly legible.

1.3 Remaining Risks

WARNING

Heated Samples

Depending on the used heating device the sample may be heated up to 400 °C (or higher in case of malfunction). At these temperatures the sample may emit harmful gases.

Stay well below the samples decomposition temperature or supply sufficient venting.

CAUTION

Hot surface

Parts of the instrument may become very hot or very cold during operation.

Do not touch these parts of the instrument without adequate protective measures or let it cool down before handling.

CAUTION

Moving parts

Moving parts may generally expose a risk of getting injured.

Keep clear of moving parts.

CAUTION

Heavy object

The MCR is heavy (up to 60 kg with accessories), therefore adequate lifting by two persons or using a hoisting device is required to prevent injuries and instrument damage. Never lift the MCR by its head.

There are recessed grips at the bottom of the instrument (4 in Fig. 2 [▶ 8] and 1 in Fig. 3 [▶ 8]), which should always be used to lift the MCR.

Some of the accessories and measuring geometries may represent an additional risk; e.g.:

- The SCF (solid cylindrical fixture) and SRF (solid rectangle fixture) measuring geometries allow mounting sharp objects.
- The BIC (bicone) measuring geometries have a very sharp edge that additionally may be rotating at a high speed (up to 3000 rpm).
- The CC (concentric cylinder) or DG (double gap) measuring geometries may expose a shearing hazard between the cylinder and the cup when the cylinder is immersed into the cup.
- The surroundings and objects near the heating devices may also become hot or cold.

Wear protective gloves

Wear protective gloves when handling the MCR.

Wear safety goggles

Wear safety goggles when handling the MCR.

NOTICE

Observe the safety information in the documentation of the accessories and measuring geometries.

2 MCR - An Overview

The **M**odular **C**ompact **R**heometer series incorporates an EC-motor with ball and air bearings and is designed for a wide range of measurement tasks. Temperature control and sample-specific accessories adapt the instrument to the desired application. The rheometer software together with Toolmaster (the automatic recognition and configuration system) provide a user-friendly interface.

All mechanical and electrical control components are incorporated into one unit. The movable measuring head ensures sufficient space for sample loading and trimming.

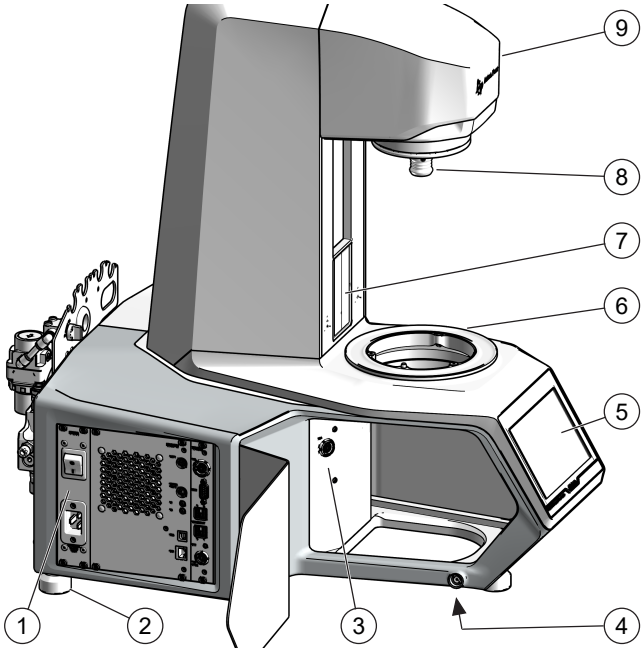


Fig. 2: *Overview of MCR (left and front) with side cover*

1 *Power connection panel*
2 *Three adjustable feet*
3 *Inside connector*
4 *Recessed grip*
5 *Touch screen*
6 *Flange ring (Temperature device holder): mechanical self-alignment of all accessories*
7 *Trimming mirror*
8 *MCR coupling for measuring geometry*
9 *MCR measuring head*

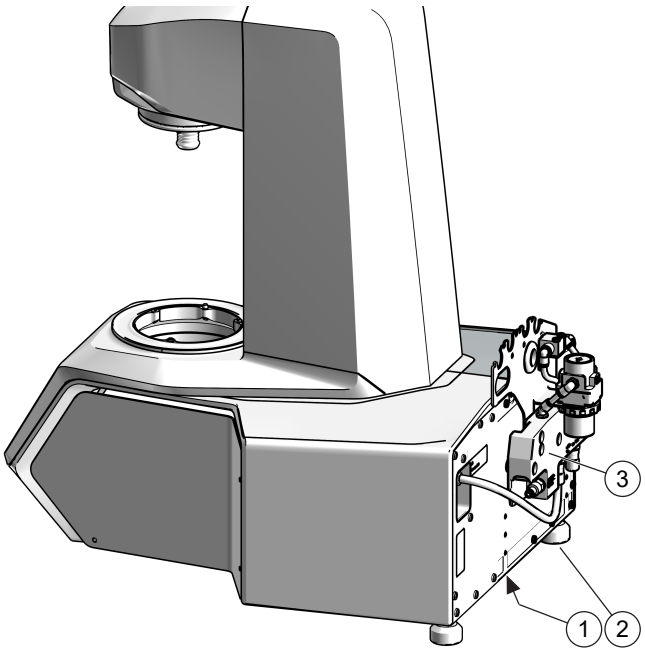


Fig. 3: *Overview of MCR (right and rear)*

1 *Recessed grip*
2 *Three adjustable feet*
3 *Air supply unit (optional)*

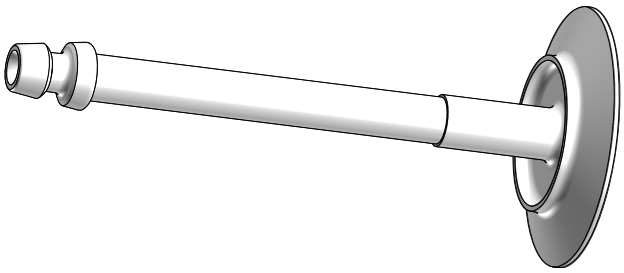


Fig. 4: *PP50 measuring geometry*

Anton Paar's MCR **measuring geometries** can be used with all suitable temperature devices and are interchangeable within their category of accessories. For example, a PP25 parallel-plate measuring geometry can be used with all plate accessories, like the PTD (Peltier Temperature Device) or ETD (Electric Temperature Device) systems. All geometry dimensions, safety limitations and calibration constants are saved in the **Toolmaster** chip located in the shaft of every measuring geometry. Made from various materials and featuring different surfaces and dimensions, all measuring geometries are optimized regarding compliance, thermal expansion and thermal conductivity.

NOTE: *The measuring geometries are not part of the MCR delivery and need to be ordered separately.*

The **SmartPave** is a dynamic shear rheometer for the measurement of the rheological properties of bitumen and asphalt. The instrument fully complies to international bitumen standards such as AASHTO, ASTM, DIN and others. It is possible to equip SmartPave with a lower Peltier plate and a Peltier hood. This combination minimizes temperature gradients in the sample and guarantees reliable measurements with extreme accuracy.

The **SmartMelt** is a dynamic shear rheometer intended for the measurement of rheological properties of polymer melts. It requires the H-ETD 400 and P-PTD 400/I temperature devices and dedicated measurement systems.

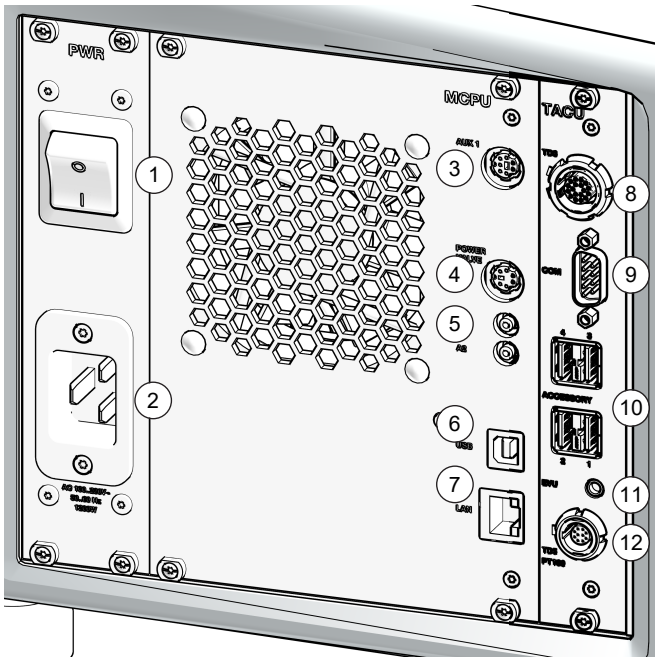
2.1 Intended Use of the Instrument

The MCR is intended for the measurement of the rheological properties of a wide range of different samples.

The MCR may only be used in the way it is described in this manual and other documentation provided by Anton Paar for this instrument and for its accessories.

2.2 Connections on MCRs

a) Left side panel connectors



b) Left inside connectors

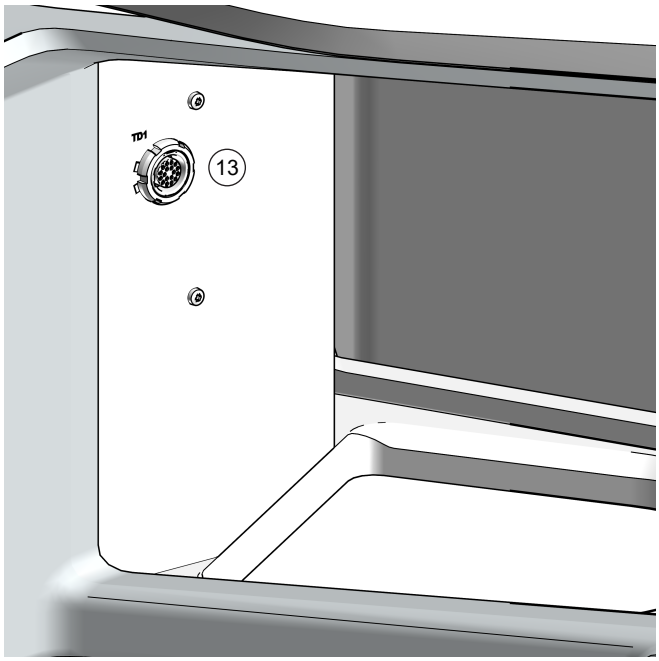
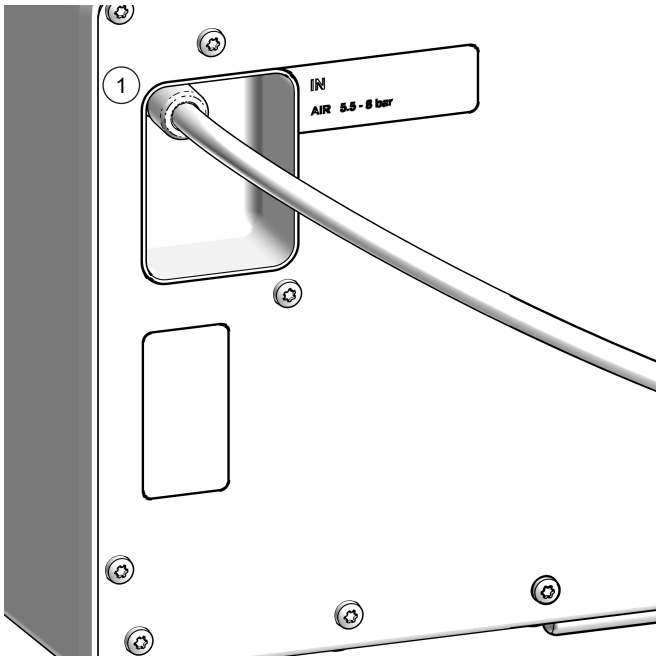


Fig. 5: *Left side connections on an MCR x3*

1 Power switch
2 Powercable connector
3 AUX1 connector
4 POWER / VALVE connector
5 A1 and A2 connectors
6 USB connector
7 LAN connector
8 TD3 connector (temperature device)
9 Serial port COM
10 ACCESSORY connectors 1 to 4 (USB)
11 EVU connector
12 TD5 / PT100 connector
13 TD1 connector (temperature device)

c) Rear connectors



d) Air supply unit (optional)

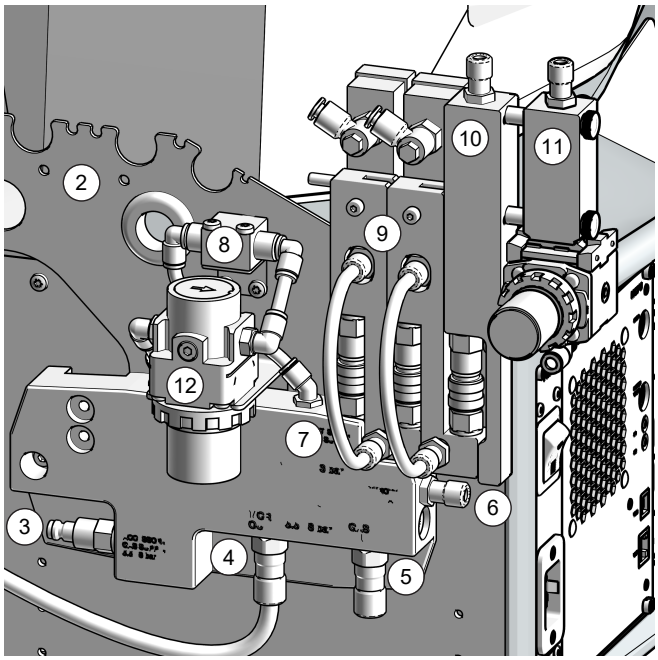


Fig. 6: *Rear connections on an MCR x3*

1 AIR IN connector (not with MCR 53)
2 Hose holder
3 Air supply unit ACCESSORY GAS SUPPLY (5.5 - 8 bar)
4 Air supply unit MCR OUT (5.5 - 8 bar)
5 Air supply unit GAS IN (5.5 - 8 bar)
6 Air supply unit THROTTLE VALVE (3 bar)
7 Air supply unit ACCESSORY GAS SUPPLY (3 bar)
8 Shut-off valve
9 Flow meters
10 Gas distributor
11 Inert gas distributor (with pressure regulator)
12 Pressure regulator

3 Checking the Supplied Parts

The MCR was tested and packed carefully before shipment. However, damage may occur during transport.

1. Keep the packing material (box, foam pieces, transport protection) for possible returns and further questions from the transport and insurance company.
2. Check the delivery for completeness by comparing the supplied parts to those noted in the delivery check list.
3. If a part is missing, contact your Anton Paar representative.
4. If a part is damaged, contact the transport company and your Anton Paar representative.

3.1 MCR Modular Compact Rheometer

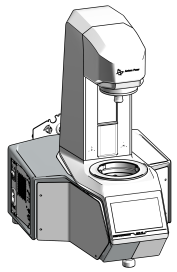
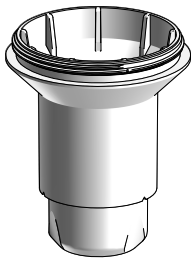
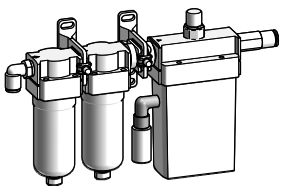
CAUTION

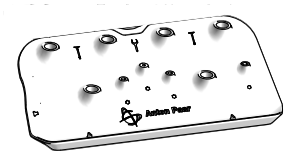
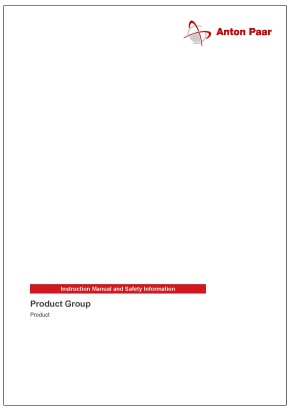
Heavy object

The MCR is heavy (up to 60 kg with accessories), therefore adequate lifting by two persons or using a hoisting device is required to prevent injuries and instrument damage. Never lift the MCR by its head.

There are recessed grips at the bottom of the instrument (4 in Fig. 2 [▶ 8] and 1 in Fig. 3 [▶ 8]), which should always be used to lift the MCR.

Table 1: Supplied Parts

Symbol	Pcs.	Article Description	P/N
	1	MCR 53 MODULAR COMPACT RHEOMETER Modular Compact Rheometer with ball bearing	385252
	or 1	MCR 73 MODULAR COMPACT RHEOMETER Modular Compact Rheometer	385253
	or 1	MCR 93 MODULAR COMPACT RHEOMETER Modular Compact Rheometer	385255
	or 1	SmartMelt 73 POLYMER MELT RHEOMETER Modular Compact Rheometer for polymer rheology	385254
	or 1	SmartPave 93 DYNAMIC SHEAR RHEOMETER (DSR) Modular Compact Rheometer for asphalt rheology	385256
	1	Protection tube	315661
	1	Box of cables, hoses, and tools	
	1	Air filter and dryer unit, SMC, model IDG3 not with MCR 53. Includes: - Air micro filter, model AFM20 - Air sub-micro filter, model AFD20 - Membrane air dryer with dew point indicator, model IDG3-F02-S - Instruction manual	169678

	1	Tool holder	
		Documentation and USB-Storage Device	

4 Installing the Instrument

4.1 Installation Requirements

The setup location and surroundings should meet the requirements of a typical laboratory (refer to below and Appendix A [▸ 29]).

Allow the equipment to reach ambient temperature before installation. This is very important, if the equipment has been stored or transported at lower temperatures.

CAUTION

Moving parts

Moving parts may generally expose a risk of getting injured.

Keep clear of moving parts.

CAUTION

Heavy object

The MCR is heavy (up to 60 kg with accessories), therefore adequate lifting by two persons is required to prevent injuries and instrument damage. Never lift the MCR by its head.

There are recessed grips at the bottom of the instrument, which should always be used to lift the MCR.

CAUTION

Risk of squeezing body parts by upwards moving measuring head

Leave at least 0.5 m space above the MCR.

Place the instrument on a stable, flat lab bench which is free of vibrations:

- leave enough space to the left of the instrument, so that the power switch can easily be accessed, and the ventilation fan is not blocked

To ensure temperature stability and trouble-free measurement, never place the MCR:

- next to a heating facility
- near an air conditioning, ventilation system or an open window
- in direct sunlight

And further:

- Keep the instrument away from vibrations (e.g. caused by other instruments on the same lab bench).
- Keep the instrument away from magnetic fields.
- For best results, we recommend operating the MCR in an air-conditioned room at a constant temperature.
- Install the MCR at that room temperature at which it will be usually operated.
- Read the Safety Instructions in Section 1 [▸ 5].
- Find all Technical Data in Appendix A [▸ 29].

NOTICE

Make sure that you have connected and switched on a suitable compressed air supply (according to ISO 8573-1, class 1.6.1) with correct pressure before you touch or move the couplings of the measuring drives.

NOTICE

Always mount the MCR protection tube to protect the coupling of the measuring drive and the measuring drive when the MCR is not in use.

NOTICE

Don't place liquids above any part of the instrument, especially not above the power supply. Liquids could get spilt and cause damage to the instrument.

4.1.1 Cooling Fluid

Choice of Cooling Fluid:

There are various different use-cases for cooling fluids and the correct choice of the cooling fluid depends on them:

- Temperature control of Measuring Drive: Mixture of water and antifreeze as defined in this manual.
- Cooling, counter-cooling or temperature control of Temperature Devices and other Accessories: Mixture of water and antifreeze as defined in this manual or other relevant manuals.
- High temperature requirements: H20S fluid as defined in the relevant manuals.
- Low temperature requirements: H5 fluid as defined in the relevant manuals.

Recommended antifreeze:

Recommended antifreeze with corrosion protection are BASF G30, G40 and G48 or equivalent products of other suppliers.

Refer to Technical data [▸ 29] for information about the choice of cooling liquid.

CAUTION

Highly inflammable

Never use ethanol or any other low-viscosity solvent as coolant. The rheometer's quick couplings are not sufficiently solvent-proof.

For circulators offered by Anton Paar (except for the Julabo AWC100):

- Use a mixture of 60 % distilled, deionized water and 40 % concentrate of engine coolant antifreeze with corrosion protection suitable for aluminum.

– In case of evaporation of the coolant, refilling must always be carried out with the correct mixing ratio of 60:40.
– Verify the pH-value of the coolant in intervals of two months in order to ensure a stable, neutral quality between pH = 7 and 9.

  If the pH value drops below pH = 7, the coolant mixture must be changed immediately. The addition of pH-increasing agents is not permitted.
– Dispose of the coolant according to the instructions on the manufacturer's safety data sheet.
– In the case of a blockage in the cooling circuit, contact an AP service technician immediately.

For the Julabo AWC100 circulator:

– Use a mixture of 90 % distilled, deionized water and 10 % concentrate of engine coolant antifreeze with corrosion protection suitable for aluminum.
– In case of evaporation of the coolant, refilling must always be carried out with the correct mixing ratio of 90:10.
– Verify the pH-value of the coolant in intervals of two months in order to ensure a stable, neutral quality between pH = 7 and 9.
– If the pH value drops below pH = 7, the coolant mixture must be changed immediately. The addition of pH-increasing agents is not permitted.
– Dispose of the coolant according to the instructions on the manufacturer's safety data sheet.
– In the case of a blockage in the cooling circuit, contact an AP service technician immediately.

NOTICE

Damage caused by unsuitable cooling water quality

– Hard water is not suitable for temperature control because it leads to calcification.
– Ferrous water will cause formation of rust even in instruments made of stainless steel.
– Water must not contain chlorine or added minerals. Chlorinated water will cause pitting corrosion.
– Due to their corrosive characteristics, pure distilled water and deionized water are unsuitable as open circuit cooling fluids.
– Avoid microbiological proliferation in the bath water as organic particles can clog the instruments.

4.2 Software Installation

You will find a USB-storage device in the box of the MCR. This USB-storage device contains all required software and some additional information.

Install the RheoCompass software on the PC that will be connected to the MCR according to the instructions that were delivered with the software.

To install RheoCompass on the PC, insert the installation USB storage device and follow the instructions you will find on the USB device.

4.3 Unpacking the MCR

CAUTION

Heavy object

The MCR is heavy (up to 60 kg with accessories), therefore adequate lifting by two persons or using a hoisting device is required to prevent injuries and instrument damage. Never lift the MCR by its head.

There are recessed grips at the bottom of the instrument (4 in Fig. 2 [▸ 8] and 1 in Fig. 3 [▸ 8]), which should always be used to lift the MCR.

1. Cut the straps and lift off the upper part of the cardboard box.
2. Take out the documentation, the box of hoses, the tool holder, and the poster (3, 1, 2, and 4 in Fig. 7 [▸ 14]).

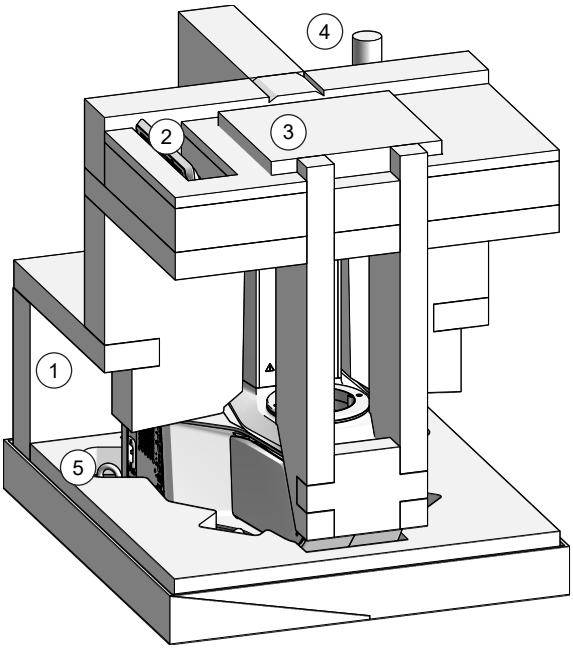


Fig. 7: *Unpacking the MCR*

1 Box with Cables, hoses and tools
2 Toolholder
3 Documents
4 Poster
5 Lifting eyes

3. Lift off the upper packing foam.
4. Open the plastic bag and pull it down over the sides of the MCR. Then remove the five bags of desiccant.
5. If you are using a hoisting device, continue below.
6. Two persons are required to lift the MCR by the front and rear recessed grips (4 in Fig. 2 [▸ 8] and 1 in Fig. 3 [▸ 8]).

When using a hoisting device:

1. Attach lifting belts to all four lifting eyes.
2. Use the lifting device to place the MCR onto the lab bench.
3. Remove the lifting belts.
4. Slightly tilt the MCR backwards and pull out the wooden lifting board towards the front.

NOTICE

Risk of damaging the instrument

Don't leave the wooden lifting board underneath the MCR. It would reduce the cooling of the electronics and lead to overheating.

TIP: *Keep all packing material for later use.*

4.4 Installing Flow Indicators

To check if the fluid circulator is working properly and the fluid's quality is appropriate, we recommend installing flow indicators (delivered with circulators purchased from Anton Paar).

Make sure the circulator is turned off. Cut the outlet hose of the circulator at a point where the flow indicator will always be clearly visible. Mount the flow indicator between the two hose ends with the supplied hose clamps.

NOTICE

Risk of damage

Handle with care. Don't overstrain the flow indicators. Check for leak-tightness after mounting.

The coolant flowing through the flow indicator should always be clear and devoid of visible particles.

4.5 Connecting the MCR to the Air Supply

To avoid damaging the air bearings, connect the air supply with the supplied hose to the MCR.

Make sure that the air supply meets all requirements given in Appendix A [▸ 29].

NOTICE

Never operate the MCR or move the coupling unless you have connected a suitable compressed air supply with correct pressure. It is good practice to connect the air supply first, before doing anything else with the instrument.

1. Mount the Air filter and dryer unit in an upright position near the rear side of the MCR.

   Keep in mind that you will need to access the filters for maintenance.

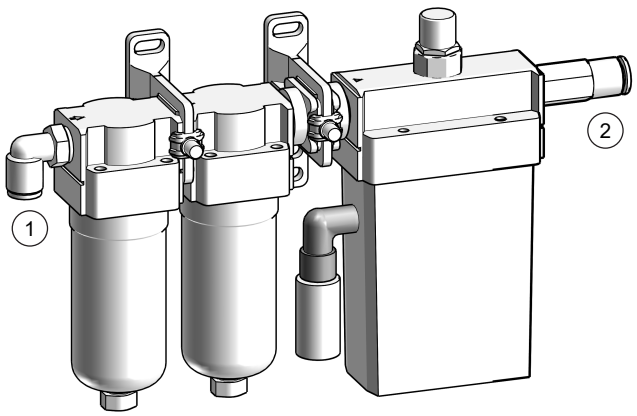


Fig. 8: *Air filter and dryer*

1 Air in connector

2 Air out connector

2. Connect the supply of pressurized air to the input of the filter (1 in Fig. 8 [▸ 15]).
3. Connect the output of the dryer (2 in Fig. 8 [▸ 15]) to the AIR IN connector (1 in Fig. 6 [▸ 10]).

   If you are using the optional air supply unit, connect to the GAS IN connector (5 in Fig. 6 [▸ 10]).

4.6 Connecting the MCR to Power

Connect the power cable of the MCR to a voltage supply that meets the specifications of the MCR (refer to Appendix A [▸ 29]). Only use an outlet with protective earth to avoid the risk of an electric shock and use the cables supplied by Anton Paar.

NOTICE

When the MCR is taken out of operation, disconnect the power cable.

4.7 Removing the Transport Protection

NOTICE

Do not continue if an error message is displayed.

NOTICE

The bearing is especially sensitive to side loads, even with connected air pressure. Do not press the coupling or a connected measuring system sidewards.

1. Unlock the transport protection by turning the lower part clock-wise. Then remove it.
2. Switch on the instrument. The main switch is on the panel on the left side of the instrument.

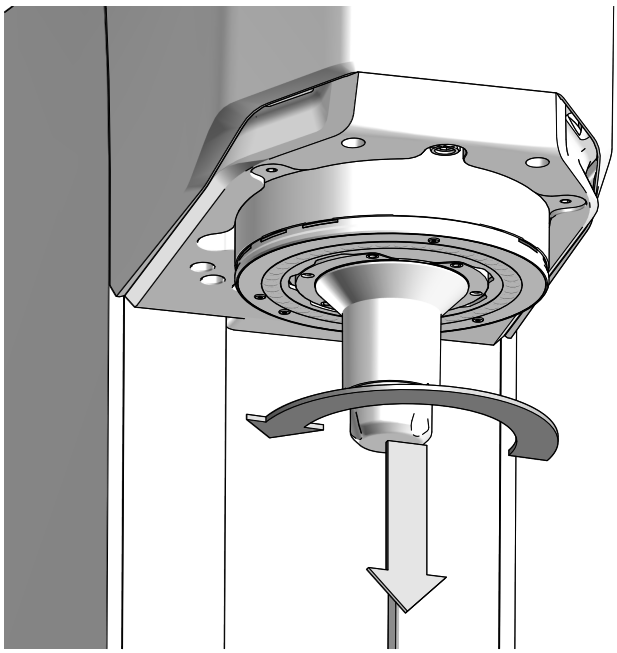


Fig. 9: *Unlocking the protection tube*

3. Wait for the instrument to boot. The boot sequence is finished when the *Initialization* screen is shown.

Fig. 10: *MCR initializing screen*

NOTICE

Always mount the MCR protection tube to protect the coupling of the measuring drive and the measuring drive when the MCR is not in use.

CAUTION

Moving parts

There is a risk of body parts being pinched by the moving measuring head.

Keep clear of the measuring head while it is moving.

4. Press *START* to initialize the device. The *Home* screen is displayed.

4.8 Connecting to the PC

You have two possibilities to connect the MCR to a network or PC. Find the suitable cables in the accessory kit:

– MCR USB - PC directly: using the USB cable

– MCR LAN - network: using the Ethernet cable

The instrument has to be set to one of these options from the instrument menu. The default setting is USB.

Refer to Section 5.3 [▶ 23] for details about changing the various settings.

To change the communication setting from USB:

1. Switch on the MCR and wait for the boot procedure to finish (refer to Section 4.7 [▶ 15]).
2. Press *Settings* and then *Connection*.
3. Select the desired *Connection type*.

4.8.1 USB

Connect the USB cable to the connector marked "USB" (6 in Fig. 5 [▶ 9]) on the connection panel of the instrument and to a free USB port on the computer on which RheoCompass will be installed.

NOTICE

Only use the USB cable provided by Anton Paar.

The required USB drivers are installed together with RheoCompass.

4.8.2 Ethernet

Each instrument is equipped with an Ethernet interface. The MAC address of this interface is given on the instrument. The TCP/IP protocol is used for the communication between RheoCompass and the instrument.

To connect the instrument to the network, use a patch panel connector or an Ethernet switch. The included standard patch cable can be used for the direct connection and for most modern switches.

Connect the patch cable to the connector marked "LAN" on the connection panel (7 in Fig. 5 [▶ 9]) of the instrument and to the network.

IMPORTANT: *Disable any WLAN connection in the control panel of your PC (it is not sufficient to turn off the WLAN with a switch on the PC). An active WLAN connection might have negative effects on the LAN connection to the MCR.*

4.9 Mounting and Connecting a Liquid Cooled Temperature Devices

CAUTION

General Risks

Read and observe the safety instructions you will find in the documentation of the accessories used together with the MCR.

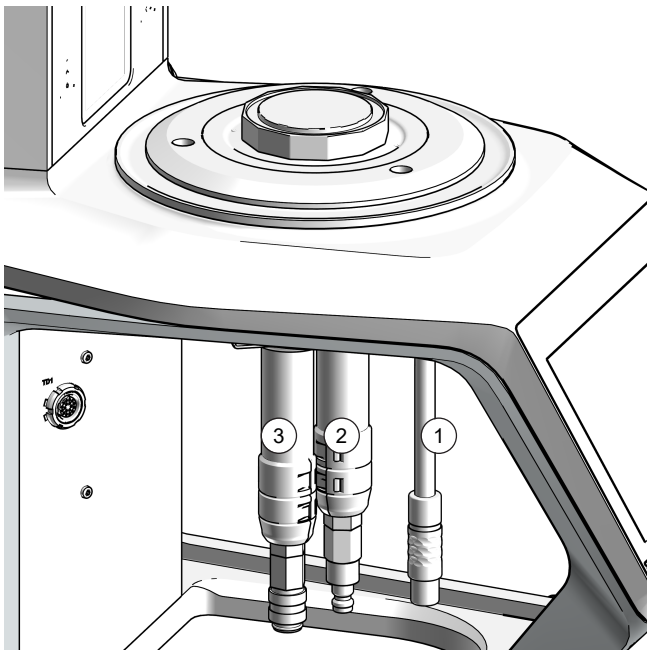


Fig. 11: *Temperature device (P-PTD) installed on the MCR*

1 Control cable
2 Temperature control hose OUT
3 Temperature control hose IN

Anton Paar GmbH offers different types of heating devices mounted in several different ways. The example shown here is a P-PTD and an H-PTD.

Always refer to the respective manual for details.

1. Move the measuring head of the MCR to the *Topmost Position*.
2. Attach the protection tube to protect the MCR coupling.
3. Before installing the plate open both side covers of the MCR.
4. Guide the control cable and the temperature control hoses through the MCR flange ring.
5. Place the plate on the flange ring and align it with the guide pin.
6. First tighten the screw opposite the pin, then fasten the two others so that they are hand-tight.

INFORMATION: *There are two types of screws available. The knurled screws can be opened and fixed without using a tool, but they cannot be used in combination with all accessories.*

7. Connect the control cable (1 in Fig. 11 [▶ 17]) to the TD1 (13 in Fig. 5 [▶ 9]) connector on the MCR.
8. Guide the temperature control hoses towards the right side of the MCR, either underneath it or through the right side opening.
9. Remove the protection tube.
10. Place the hood in such a way that the guiding rail is placed at a right angle to the measurement area and fit the fixing ring screw (1 in Fig. 12 [▶ 18]) to the flange on the MCR head.
11. Be careful to align the hood before tightening the fixing ring screw to avoid damaging the thread. Tighten the ring screw hand-tight.
12. Connect the control cable to the connector marked TD3 (8 in Fig. 5 [▶ 9]).
13. Connect the outlet of the fluid circulator to the inlet hose of the hood (5 in Fig. 12 [▶ 18]).
14. Connect the outlet hose of the hood (6 in Fig. 12 [▶ 18]) to inlet hose of the temperature plate (3 in Fig. 11 [▶ 17]).
15. Connect the outlet hose (2 in Fig. 11 [▶ 17]) of the temperature plate to the inlet of the fluid circulator.

INFORMATION: *If you are using the temperature plate without the hood (which is not recommended), connect the hoses directly to the circulator.*

16. Connect the air hose to the air supply unit (6 in Fig. 6 [▶ 10]).

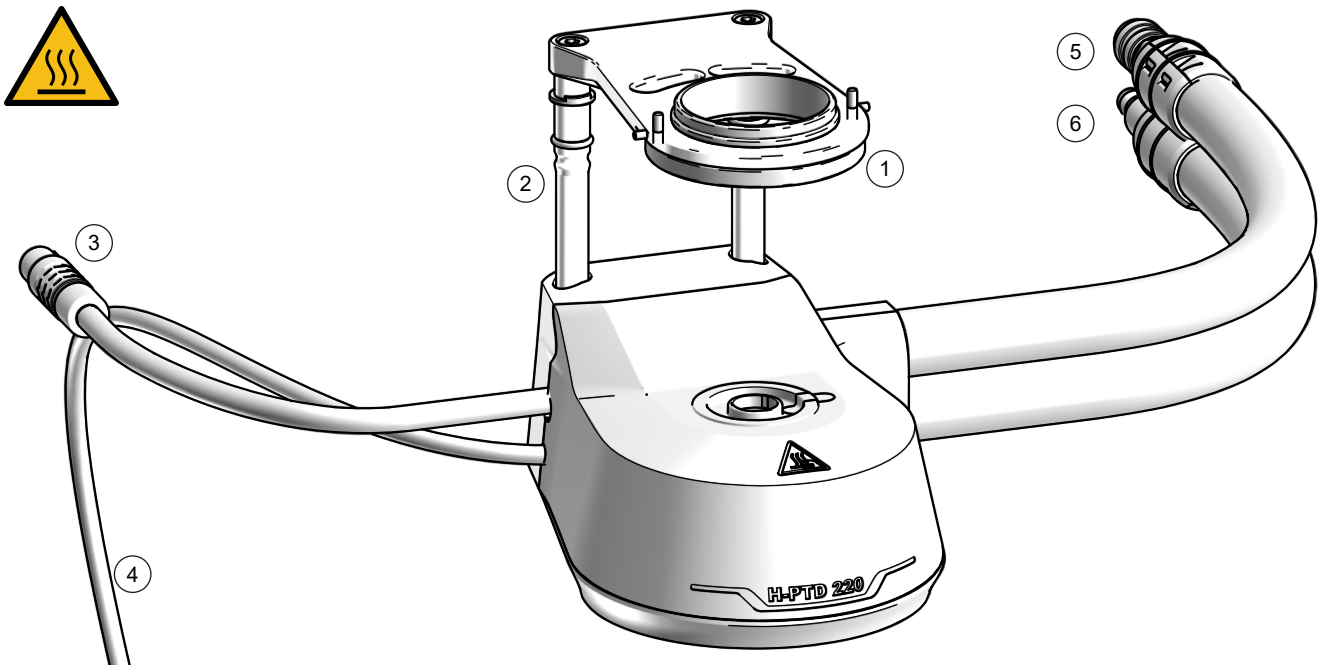


Fig. 12: *Example of a hood*

1 *Fixing ring screw for mounting on the MCR*
2 *Guiding rail*
3 *Control cable to MCR (Pt100 / heating)*
4 *Hose for air/gas supply*
5 *Temperature control hose IN*
6 *Temperature control hose OUT*

Installing Flow Indicators:

To check if the fluid circulator is working properly and the fluid is circulating, we recommend installing the supplied flow indicator. Therefore, before you connect the hoses, cut the hoses coming from the circulator at a point where the flow indicator will always be clearly visible. Mount the flow indicator between the two hose ends with the supplied hose clamps.

4.10 Installing the Fluid Circulator (optional)

You only need to install the fluid circulator if it is going to be controlled by the RheoCompass. Refer to the RheoCompass interactive help and the instruction manual of the circulator for details.

To remotely operate a Julabo thermostat, proceed as follows:

1. Make sure the control cable between the circulator and the MCR is connected.
2. Activate the remote control mode in the settings of the thermostat (refer to circulator manual). If the thermostat is to be operated manually at a later time-point, the setting has to be changed back again.
3. In RheoCompass, go to *Setup* and select the tab *Accessories*.
4. Right-click on any accessory and select *New*.
5. Select *Controller (actual value feedback, connected to COM or USB interface)* in the Type menu.
6. Select the appropriate fluid circulator.
7. If needed, configure the communication interface in the *Operational Settings* tab as follows:

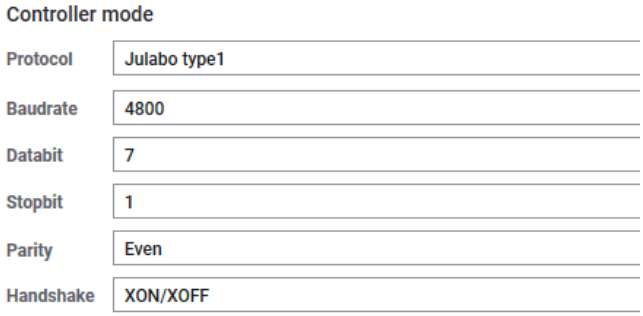


Fig. 13: *RheoCompass settings for Julabo circulator.*

8. By default, the thermostat is set to *RTS/CTS* (hardware handshake). This setting has to be changed to *XON/XOFF* (software handshake) on the circulator (refer to circulator manual). This setting is used by default in the suitable Julabo templates of RheoCompass.
9. Go to *Measuring Device* > *Configure*
10. Select the appropriate fluid circulator and connection type for your configuration under *Temperature control* > *Additional cooling* or *Additional controller*.
11. Now you can remote control the circulator temperature either by the *Control Panel* > *Accessories* or within a test work flow (Test definition) by the respective measurement action item.

NOTE: *A fluid circulator shall be selected under:*

– *Temperature Control - Additional controller if it is used to control the sample temperature of a measuring cell without a built-in temperature controller.*

– *Temperature Control - Additional cooling if it is used to set the counter-cooling temperature of a Peltier type measuring cell or for active cooling of electrical devices such as the P-ETD*

4.11 Leveling the Instrument

For correct measurements the MCR has to be leveled with the adjustable feet.

NOTICE

The leveling of the MCR may influence measurements at small torque values. Therefore, check and repeat the leveling regularly. Especially repeat the leveling after moving the instrument.

The MCR has a built-in electronic bubble level:

1. After turning on the MCR select *Start* > *Settings* > *Leveling*.
2. If the MCR is not leveled correctly the display will show you which adjustable feet (2 in Fig. 2 [▶ 8]) you need to turn to correct the leveling.
3. When you are done, the message "*Instrument leveled correctly*" is displayed and you can go back to the home screen.

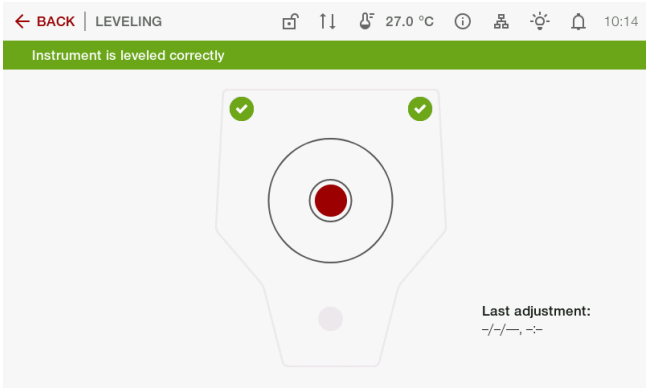


Fig. 14: *MCR correctly levelled*

4.12 Mounting a Measuring Geometry

CAUTION

General Risks

Read and observe the safety instructions you will find in the documentation of the accessories used together with the MCR.

CAUTION

Hot Surface

Parts of the instrument may become very hot during operation.

Do not touch these parts of the instrument without adequate protective measures or let it cool down before handling.

Anton Paar GmbH offers a wide range of different measuring geometries. Please contact our local distributor for details.

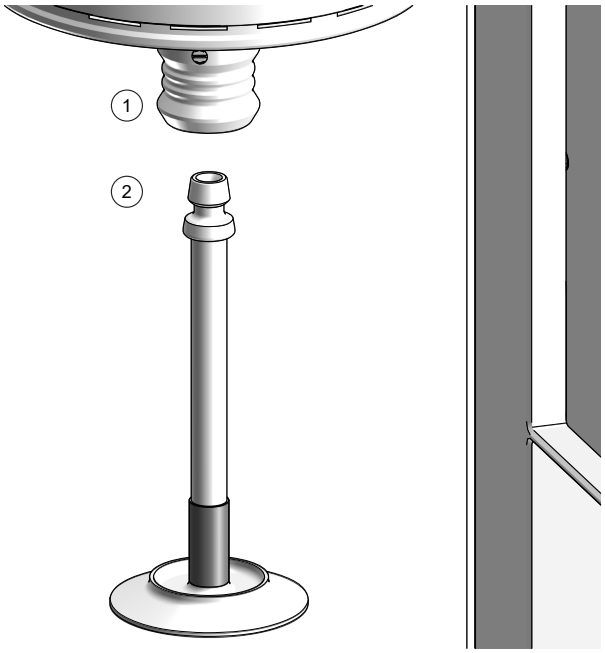


Fig. 15: *Mounting a measuring geometry*

1 Coupling
2 Measuring geometry

NOTICE

Make sure that you have connected and switched on a suitable compressed air supply (according to ISO 8573-1, class 1.6.1) with correct pressure before you touch or move the couplings of the measuring drives.

NOTICE

The bearing is especially sensitive to side loads, even with connected air pressure. Do not press the coupling or a connected measuring system sidewards.

1. Move the sleeve of the MCR coupling (1 in Fig. 15 [▶ 19]) upwards.
2. Turn the coupling until the marker on it matches the marker on the measuring geometry.
3. Insert the measuring geometry (2 in Fig. 15 [▶ 19]) into the coupling of the MCR.
4. Pull down the sleeve of the MCR coupling to fix the measuring geometry.

To remove the measuring geometry, hold it with one hand and then push the sleeve of the MCR coupling upwards. Then carefully take out the measuring geometry.

NOTICE

Always handle the measuring geometry with care, since minor damage may cause serious measurement errors.

4.13 Mounting a Flow Meter Unit (FMU)

CAUTION

General Risks

Read and observe the safety instructions you will find in the documentation of the accessories used together with the MCR.

Depending on the accessory you use with the MCR, it might be necessary to use a flow meter unit (FMU) to control the flow of the air or of other gases for optimal functioning of the device.

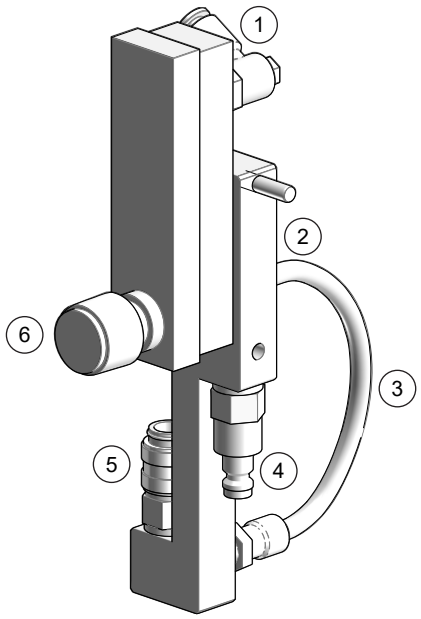


Fig. 16: *Flow meter unit*

1 Connector to accessory
2 Connector to flow regulator
3 Air hose
4 Connector to compressed air distributor (or previous FMU)
5 Connector for next FMU
6 Knob for flow adjustment

1. Mount the FMU by pushing its connector (4 in Fig. 16 [▸ 20]) onto the quick connector on the air supply unit on the rear of the MCR (7 in Fig. 6 [▸ 10]). Make sure it fits properly.
   The first FMU is mounted directly to the compressed air distributor. All subsequent FMUs are mounted to the previous FMU.
2. Connect the accessory with the supplied hose to the outlet of the flow meter unit (1 in Fig. 16 [▸ 20]).
3. Adjust the air flow by turning the knob (6 in Fig. 16 [▸ 20]). Read out the value on the upper side of the ball (refer to Fig. 17 [▸ 20]).

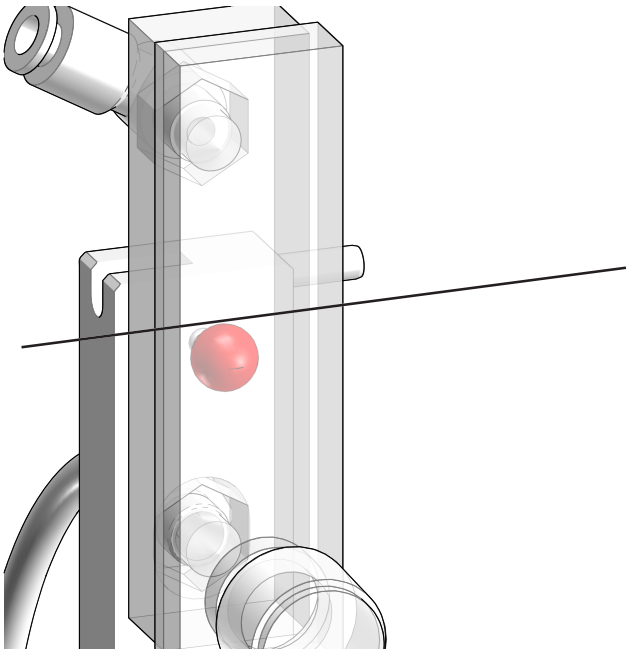


Fig. 17: *Setting the flow rate*

4.14 Mounting the Inert Gas Option

WARNING

Danger of suffocation

High concentrations of inert gas may cause suffocation. Make sure to follow all safety measures for the use of inert gases. Only use inert gas in well-ventilated areas and provide a gas alarm.

When you use separate air/gas supplies for heating and shaft cooling, proceed as follows. It is assumed that the air supply unit has been installed correctly.

1. Close the shut-off valve on the compressed air distributor.
2. Attach the inert gas option (1 in Fig. 18 [▸ 21]) to the gas distributor (10 in Fig. 6 [▸ 10]) using the two knurled screws.
3. Connect the inert gas supply to the connector below the pressure regulator of the inert gas option (2 in Fig. 18 [▸ 21]).

NOTICE

Do not change the setting of the pressure regulator. It is trimmed for best performance of the heating devices.

4. Connect all gas hoses you want to have supplied with inert gas to the connectors on the front and top of the inert gas option.
5. In case you want to supply a device with inert gas that uses an FMU, remove the hose (3 in Fig. 18 [▸ 21]) from that FMU and connect a suitable hose between the FMU's gas in connector (4 in Fig. 18 [▸ 21]) and the inert gas option.
6. Open the gas supply before the measurement.

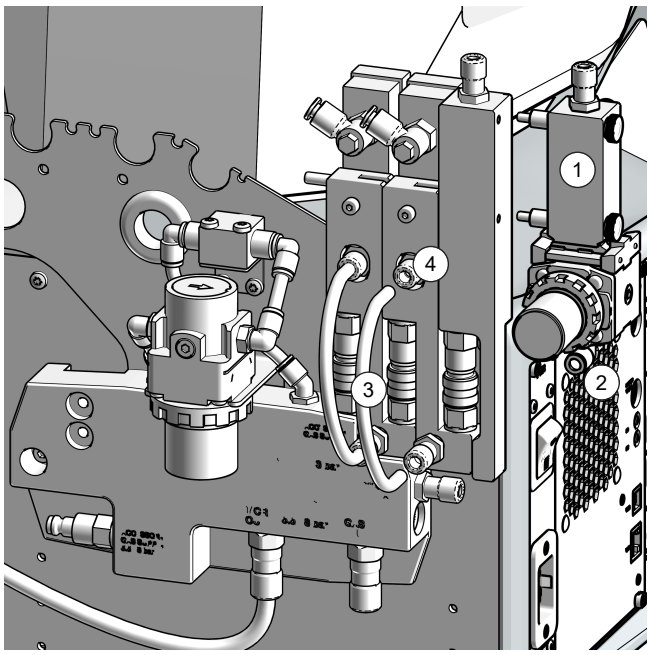


Fig. 18: *Mounting the inert gas option*

1 *Inert gas option*
2 *Inert gas in*
3 *FMU hose*
4 *FMU gas in*

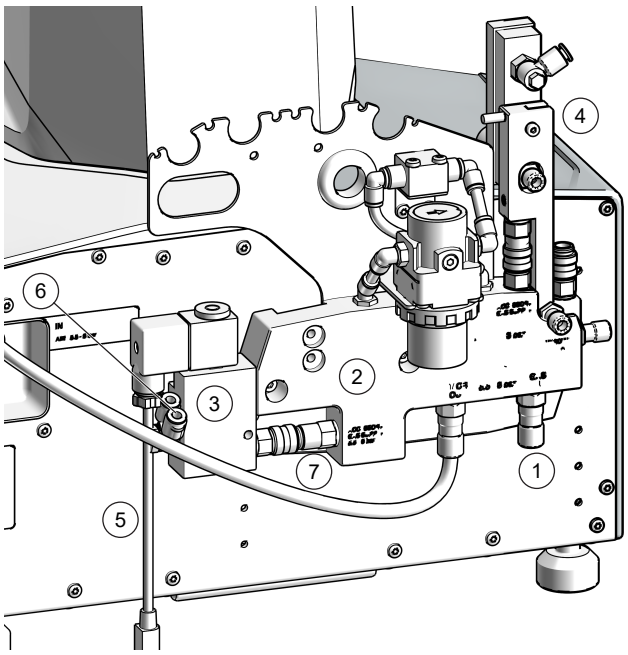


Fig. 19: *Magnetic valve*

1 *GAS IN connector*
2 *Air supply unit*
3 *Magnetic valve*
4 *FMU*
5 *Electrical cable*
6 *Air connector from magnetic valve*
7 *Air supply unit ACCESSORY GAS SUPPLY (5.5 - 8 bar)*

4.15 Mounting a Magnetic Valve

CAUTION

General Risks

Read and observe the safety instructions you will find in the documentation of the accessories used together with the MCR.

A magnetic valve controls the flow of air/gas supplies automatically.

1. Connect the magnetic valve (3 in Fig. 19 [▶ 21]) to the out connector of the air supply unit (7 in Fig. 19 [▶ 21]).
2. If not done before, connect the air/gas supply to the air in connector of the air supply unit (1 in Fig. 19 [▶ 21]).
3. Connect the electrical cable to the connector POWER VALVE of the MCPU board (4 in Fig. 5 [▶ 9]) on the left side of the instrument.

5 Operating the Instrument

5.1 Switching on the Instrument

When you have finished connecting all cables and hoses, switch on the MCR with the main power switch on its left side (1 in Fig. 5 [▶ 9]).

After the MCR has finished the boot procedure and is ready, the following screen is displayed:

Fig. 20: *MCR ready*

NOTICE
Do not continue if an error message is displayed.

After pressing *START* and after initialization, the Home screen is displayed.

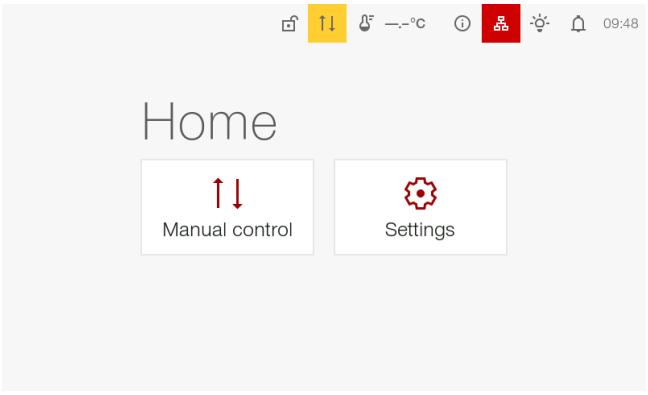


Fig. 21: *Home screen*

5.2 Manual Control Screen

After pressing *Manual control* on the Home screen (refer to Fig. 21 [▶ 22]), the Manual Control Screen shows following information:

- Current temperature at the sample
- Measuring distance
- Axial forces
- Use the arrows to move the measuring head to the defined positions or up and down
  - Topmost position
  - Loading position
  - Waiting position
  - Measuring distance
- Set the desired temperature and turn temperature control on and off:

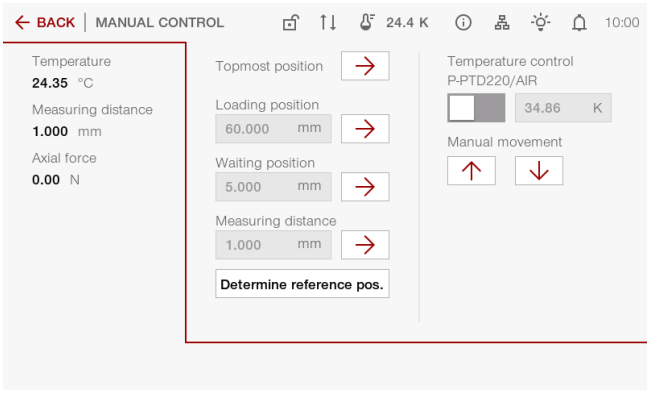


Fig. 22: *Manual control screen*

- Display measuring drive related information and activate drive actions:

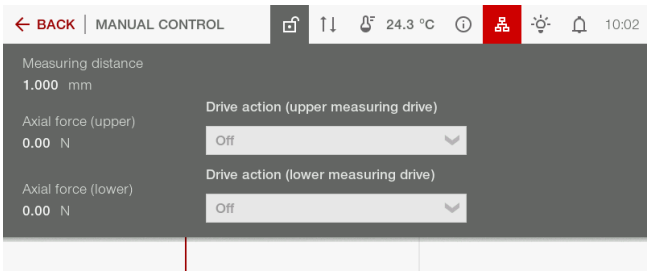


Fig. 23: *Measuring drive related information*

- Display lift drive related information and activate lift drive actions:
  - Compressive force
  - Force balancing
  - Measuring distance
  - Tensile force

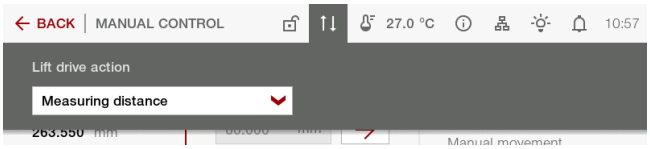


Fig. 24: *Lift drive related information*

- 24.4 °C Display set temperature and temperature history:

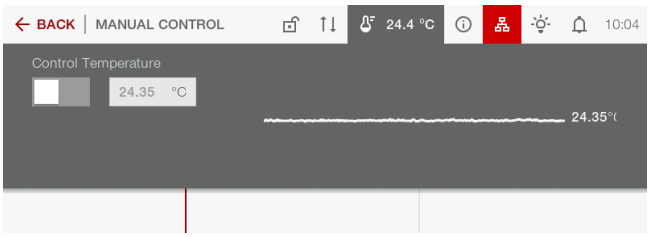


Fig. 25: *Temperature control*

- Display information about the system setup:

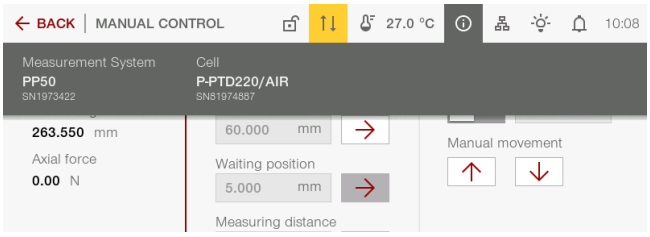


Fig. 26: *Device Information*

– Display information about the connection to RheoCompass:

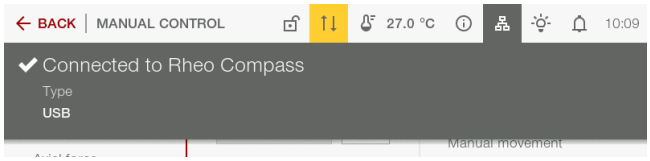


Fig. 27: *Software connection*

– Turn the lights on and off:

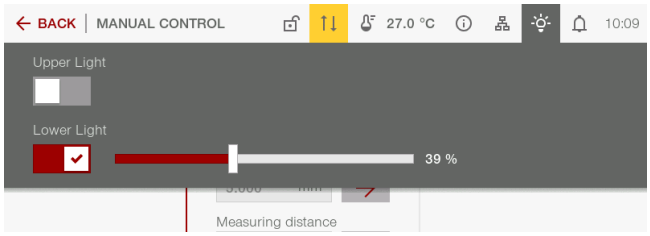


Fig. 28: *Light controls*

– Display the message log:

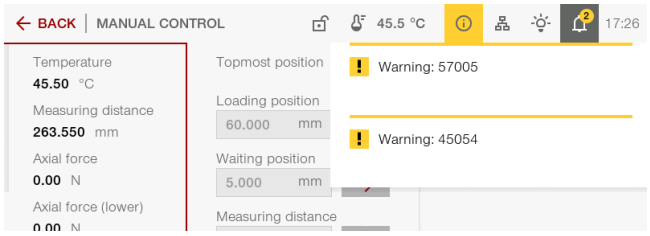


Fig. 29: *Message log*

– The background color of the icons indicates errors (red) or warnings (yellow).

5.3 Settings Screen

After pressing Settings on the Home screen (refer to Fig. 21 [▶ 22]), the Settings Screen shows following information:

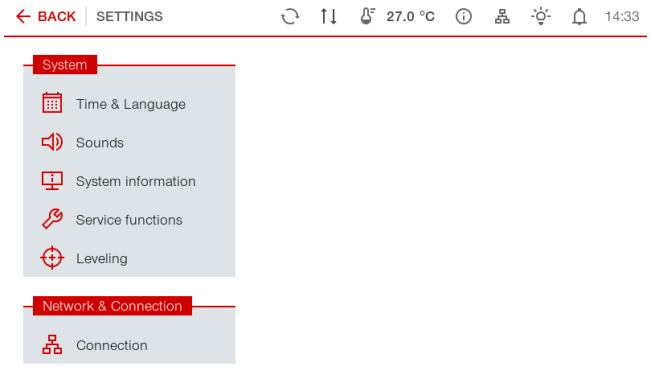


Fig. 30: *Settings*

– Change time and language settings

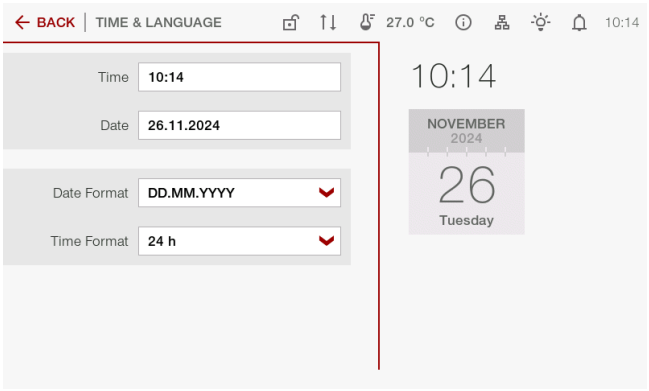


Fig. 31: *Time & Language*

– Change the connection settings

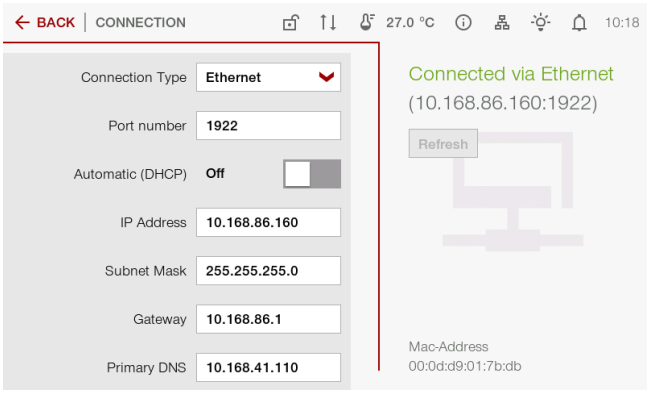


Fig. 32: *Connection*

– Leveling: refer to Section 4.11 [▶ 19].

SERVICE FUNCTIONS: *The service functions are reserved for Anton Paar service technicians and only accessible with password.*

5.4 MCR Maintenance Indicator

The MCR should be maintained and calibrated by qualified service technicians in regular intervals. To remind you of this service, the MCR has a built-in maintenance countdown.

Starting 30 days before the planned maintenance date the MCR will display the number of remaining days in the title line of the MCR display. After the planned date the maintenance countdown will continue with negative numbers.

The MCR Maintenance Indicator itself does not affect the performance of the MCR in any way.

The maintenance countdown will be reset by the service technician when the requested maintenance is performed. If you want this service to be performed, please contact your local Anton Paar representative.

6 Performing a Measurement

Measurements can only be performed together with a PC and the rheometer software.

You will find further information in the RheoCompass interactive help.

To operate the MCR, it is required that the installation has been carried out as described in Section 4 [▸ 13]. The accessories and the rheometer software also have to be installed. Information on the accessories is found in the respective manual and on the provided USB storage device.

6.1 Start-up and Initialization

1. To start up the instrument, switch it on. Then wait for the instrument to boot. The instrument is ready when the touch-screen shows *Initialization*.

NOTICE

Make sure that you have connected and switched on a suitable compressed air supply (according to ISO 8573-1, class 1.6.1) with correct pressure before you touch or move the couplings of the measuring drives.

2. If not done yet, remove the protection tube and protection cover from the measuring drives.
3. Press *START*.

   During initialization, the measuring head will move to the top position to check the gap sensor. The rotor will perform several revolutions at high speed to check the position sensor.
4. Start your computer and the operating system, then start the rheometer software and select a template.
5. Switch on the accessory / accessories, for example an external temperature controller or water bath (if applicable).

TIP: *If this is the first start-up of the instrument, or before sensitive measurements, you should carry out the motor adjustment and, if necessary, the determination of the moment of inertia for the measuring geometry you are going to use.*

6. If this is not the first start-up, you can proceed with the measurement.

CAUTION

Extreme temperature

The measuring geometry, the sample and parts of the accessory may reach temperatures far below or above room temperature. Allow the equipment to reach room temperature or make sure you are protected adequately before touching any of these parts.

Continue with sample loading and measurement:

1. Mount the measuring geometry and send the required temperature to the accessory.
2. Wait for thermal equilibrium. For measuring geometries where a reference position is required, press *Determine reference position*. Wait for thermal equilibrium and press *Determine reference position* once again.
3. Move to *Loading position*.
4. Load the sample.
5. Set up the measurement parameters as described in the software manual.
6. Move to *Measuring distance*.

   For cone-plate and parallel-plate systems the movement stops at trimming position. Trim the sample and press *Continue*.

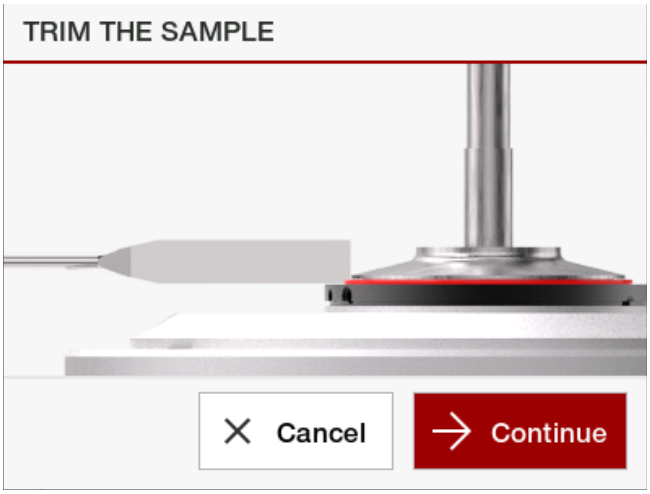


Fig. 33: *Confirm sample trimming*

7. Wait for thermal equilibrium and start the measurement.

NOTICE

Avoid scratching or otherwise damaging the measuring geometry and / or accessory.

8. After the measurement, disconnect the measuring geometry and move up the instrument head.
9. Remove the sample and clean both upper and lower measuring geometries.
10. Re-mount the measuring geometry for the next measurement.

The setting of the measurement parameters and the evaluation of the rheological data are very dependent on the sample and the selected measurement type. It would far exceed the scope of this manual to describe the rheological background. For further reading the "Rheology Handbook" (ISBN 978-3-86630-864-0) or the "Applied Rheology" book (part of delivery) by Thomas Mezger are recommended.

6.2 Sample Loading

The sample amount and the handling of the sample during loading are two of the most important factors for the correctness and reproducibility of rheological measurement results.

Since most materials are sensitive to external forces, it is essential to treat all samples as consistently as possible before measurement. Samples should be applied carefully to the measuring geometry to avoid influencing the results.

TIP: *You can find the required sample volume for every measuring geometry in the RheoCompass software.*

6.2.1 Concentric Cylinder Systems

The sample volume required for concentric cylinder systems is indicated by a marker inside the measuring cup.

Fill the cup with sample up to this mark. After lowering the measuring head to measuring position, the measuring bob should be completely immersed in the sample.

Advantages of a Concentric Cylinder System:

- easy to prevent sample from drying-out (e.g. oil film on top of sample)
- no trimming necessary
- no gap leakage at high shear rates

Disadvantages of a Concentric Cylinder System:

- relatively high sample volume required
- difficult to clean
- entrapment of air bubbles in paste-like samples
- turbulences at high shear rates
- slower temperature equilibration

6.2.2 Plate-Plate Systems

For correct filling, the sample should be just outside the rim of the measuring geometry. Ideally, all excess sample is removed at a position (trim position) just above the measuring position; then the measuring geometry is moved to the measuring position. Both too much and too little sample will lead to large errors in the measurement data.

Advantages of a Plate-Plate System:

- suitable for high viscous samples
- high shear rate range
- small sample volume
- easy to fill and to clean
- quick temperature equilibration
- measurement gap is adjustable
- samples with small particles can be measured

Disadvantages of a Plate-Plate System:

- gap leakage of the substance at too high shear rates
- different shear rates within the gap
- sample drying effects

6.2.3 Cone-Plate Systems

For correct filling, the sample should be just outside the rim of the measuring geometry. Ideally, all excess sample is removed at a position (trim position) just above the measuring position; then the measuring geometry is moved to the measuring position. Both too much and too little sample will lead to large errors in the measurement data.

Advantages of a Cone-Plate System:

- constant shear rate within entire gap due to cone shape
- small sample volume
- easy to fill and to clean
- quick temperature equilibration

Disadvantages of a Cone-Plate System:

- gap leakage of the substance at too high shear rates
- particles in sample can disrupt the measurement
- sample drying effects

6.2.4 Double Gap Systems

Put a small amount of sample in the gap of the cup. Then lower the measuring bob to measuring position (the sample shall flow over slightly). Remove excess sample from the top of the cup's center cylinder with a syringe.

Advantages of a Double Gap System:

- suitable for low viscous samples (η < 100 mPas)
- accurate temperature within entire cup
- small gap

Disadvantages of a Double Gap System:

- sample drying effects
- slow temperature equilibration
- difficult to clean
- turbulences at high shear rates

7 Upkeep and Cleaning

Perform the recommended maintenance work regularly to ensure the smooth long-term operation of the instrument.

Make sure to follow the maintenance instructions provided with any third-party products (e.g. air-compressors, dryers, filters, fluid-circulators).

- Wipe off the MCR with a dry or slightly damp, lint-free cloth. Do not scratch the surface.
- Find a list of all wetted materials below.
- Where applicable check before and during each measurement that the fluid circulator is working properly and the fluid is circulating. If the flow indicator does not work properly, check that the hose is not dirty or blocked, and check that the circulator is not defective.
- Regularly check the hose connections to the MCR. They should not be bent or blocked.
- Regularly check that the supplied air is clean, dry and oil-free, and that the compressed air supply unit meets all necessary requirements (Appendix A [▸ 29]). For details refer to the documentation of the filter system. In particular:
  - Check the air filters: the replacement interval for these elements is described in the instruction manual of the filters. Replacement filters are available from Anton Paar.
  - Check the membrane air dryer: this element should be replaced after a fixed period of operation described in the instruction manual of the air dryer. Note that, in that case, Anton Paar recommends changing the whole air filter + membrane dryer unit.
- Always handle the measuring geometry with care. Even minor damage may cause serious measurement errors. Never use force when you remove the measuring geometry from the sample or when you wipe sample off the measuring geometry.
- Regularly check the levelling as described in Section 4.11 [▸ 19]. Especially after moving the instrument.
- We recommend a maintenance contract. Please contact our local representative for details.

What?	Interval	How?
measuring geometries	before and after every measurement	clean and wipe dry
fluid-circulator flow through	weekly	check flow indicators [a]
pH of cooling fluid	every two months	measure and check whether in tolerance
replace cooling fluid	every two years	refer to manufacturer documentation
fluid-circulator		refer to manufacturer documentation
air-supply compressor		refer to manufacturer documentation
filters of air-dryer	yearly	replace filters; refer to manufacturer documentation
maintenance indicator	refer to Section 5.4 [▸ 23]	request service if necessary

[a] *If flow through is insufficient, please contact your local representative.*

7.1 Cleaning a Jammed Coupling

CAUTION

Flammable liquids

Do not perform the following actions while the temperature devices are still hot. Wait for the device to cool down to ambient temperatures.

NOTICE

Do not perform the following with the lower measuring drive. Solvent might penetrade the measuring drive and damage it.

Generally, keep the MCR coupling clean. Do not oil or grease the coupling, otherwise it could start slipping.

To test the coupling, you can slowly open and close the coupling while checking the normal force display (reset normal force first). The value should not exceed 25 N in either direction before the coupling is fully opened or closed.

– Use cotton buds and Ethanol to clean the inner surface of the coupling. Take care not to damage the transponder contact in the center of the coupling.
– If the sleeve of the coupling is jammed, you can try to carefully drip a very small amount of Ethanol or Isopropanol between the sleeve and the rest of the coupling (refer to Fig. 34 [▶ 27]). Don't apply the solvent anywhere else. Don't use any other solvents; some models of the coupling have an NBR O-ring inside that might get damaged. Then move the sleeve up and down until it runs smoothly. Dry the coupling with a lint-free cloth.

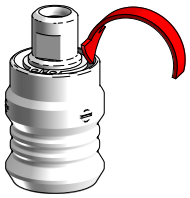


Fig. 34: *Dripping solvent into the coupling*

7.2 Wetted Parts

The following materials are wetted by the measured sample or the solvent:

Table 2: Sample Wetted Parts

Material	Description
Stainless Steel (standard)	1.4404 1.4418
Titanium	Titanium Grade 5, DIN 3.7165
Hastelloy®	Hastelloy® C276, DIN 2.4819
Quartz Glass (QGL)	Quartz glass Suprasil
Glass (GL)	Borosilicate 3.3

The following materials are wetted by the cooling fluid:

Table 3: Cooling Wetted Parts

Material	Description
Brass, Ni coated	Couplings and fittings
Stainless steel	1.4310 1.4034 1.4037
Nitrile butadiene rubber (NBR)	Hoses

7.3 Storing the Instrument

If the MCR is taken out of operation for a longer time period or if you have to return it for some reason or transport it, the measuring head and especially the air bearing have to be secured in a specific way.

CAUTION

Moving parts

Moving parts may generally expose a risk of getting injured.

Keep clear of moving parts.

NOTICE

Do not turn off the air supply before the protection tube is applied and the measuring head is in the parking position.

1. Remove the measuring geometry and (if applicable) the temperature device from your rheometer.
2. Make sure the protection tube is in the unlocked position and screw it into the measuring head.
3. Turn the lower part of the protection tube to the locked position.
4. Select *Settings* > *Service functions* and then press *Drive to park position*.
5. When the measuring head has stopped moving, you can turn off the instrument and disconnect the air supply.
6. Disconnect the cooling water supply and drain the pipes.

8 Maintenance and Repair

8.1 Maintenance Performed by an Anton Paar Representative Service Engineer

The MCR requires periodic maintenance which shall be performed by an authorized Anton Paar Service Engineer. [1]

A missing maintenance may mean that under certain conditions your warranty is no longer valid. [2]

Maintenance Interval:

– Maintenance for the MCR shall be performed once a year.
– Depending on your MCRs configuration, various maintenance kits are available, which are selected by the service technician.

Parts excluded from warranty (wear parts):

– Parts of the maintenance kits
– Filters
– O-rings
– Parts made of glass

[1] Please contact your Anton Paar representative to schedule preventive maintenance.

[2] For detailed information, please refer to general terms of delivery (GTD) on the Anton Paar website (https://www.anton-paar.com).

– Rolling bearings

8.2 Repair Performed by an Authorized Anton Paar Representative

In case your product needs repair, contact your local Anton Paar representative, who will take care of the necessary steps. If your product needs to be returned, request an RMA (Return Material Authorization Number). It must not be sent without the RMA and the filled “Safety Declaration for Instrument Repairs”. Please make sure it is cleaned before return.
Do not return products that are contaminated by radioactive materials, infectious agents or other substances that cause health hazards.

TIP: *Find the contact data of your local Anton Paar representative on the Anton Paar website (https://www.anton-paar.com) under “Contact”.*

Appendix A Technical Data

Table 4: Environmental Conditions

Environmental Conditions (EN 61010): [a]	
Operating Temperature:	+5 to +40 °C, recommended 23 °C ±3 °C
Operating Humidity:	0.1 % to 80 % relative humidity, non-condensing
Operating Altitude:	up to 5000 m
Operating Environment:	Indoor-use only
Overvoltage category:	II
Degree of pollution:	2

[a] *Environmental conditions do not automatically apply to the entire measuring setup. Please always consider the environmental conditions of all involved components.*

Table 5: Technical Data

Airborne noise emission:	< 70 dB (A)		
Power supply:	A 16 A power supply with protective earth is mandatory. Protection class I (IEC 61140). Circuit breaker 16 A with triggering characteristics type C or equivalent.		
Voltage:	AC 100 V to 230 V; max. ±10% fluctuation		
Frequency:	50 to 60 Hz		
	MCR 53	**MCR 73**	**MCR 93**
Power consumption:	1200 W		
Weight:	44 kg	45 kg	
Size: Width Height Depth	 442 mm 725 mm 596 mm		
Air/Gas Supply:			
Quality:	Clean, dry and oil-free (ISO 8573.1, class 1.6.1)		
Air pressure:	6 bar recommended (min. 5.5 bar, max. 8 bar)		
Air consumption average:	1.8 m^3_N/h (MCR without any accessories)		
Circulator:			
Temperature:	-20 °C to +70 °C		
Flow rate:	0.4 L/min to 0.7 L/min		
Maximum pressure:	1 bar		

Coolant:	Mixture of 60 % distilled water and 40 % concentrate of engine coolant antifreeze with corrosion protection suitable for aluminum. Water must not contain chlorine or added minerals. The use of pure distilled or deionized water is not permitted. The pH-value of the mixture must be between pH = 7 and pH = 9 (minimum pH = 8 at time of installation). Recommended coolant with corrosion protection is G12+.

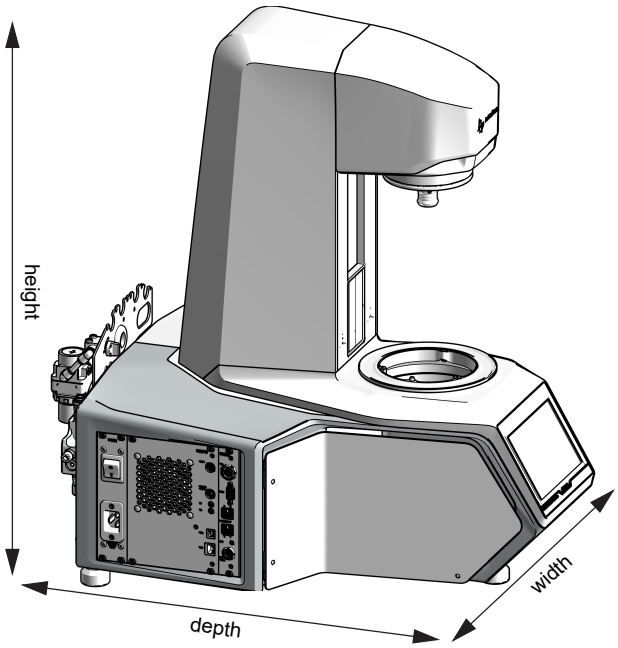


Fig. 35: *Dimensions*

NOTICE

Risk of damaging the instrument

Only use coolants as defined in Appendix A. Do not use pure tap water. Do not use silicone oil when silicone hoses are used (e.g. T-PTD 200).

CAUTION

Highly inflammable

Never use ethanol or any other low-viscosity solvent as coolant. The rheometer's quick couplings are not sufficiently solvent-proof.

Appendix B Declaration of Conformity

Docusign Envelope ID: 2E9466CA-DCD8-4367-84ED-38716AEA279D

EC Declaration of Conformity

(original)

The manufacturer **Anton Paar GmbH,** Anton-Paar-Str. 20, 8054 Graz, Austria – Europe, hereby declares that the machinery described below:

Description:	MCR 53 MCR 73 SmartMelt 73 MCR 93 SmartPave 93
Model:	MCR 53, MCR 73, SmartMelt 73, MCR 93, SmartPave 93
Material number:	385252, 385253, 385254, 385255, 385256
Serial number:	.....

are in conformity with the relevant European Union harmonisation legislation. This declaration of conformity is issued under the sole responsibility of the manufacturer.

Machinery Directive (2006/42/EC, OJ L 157/24 of 9.6.2006)

Applied harmonised standards:

- EN ISO 12100:2010

Safety objectives of the Low Voltage Directive (2014/35/EU, OJ L 96/357 of 29.3.2014)

Applied harmonised standards:

- EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019

Electromagnetic Compatibility (2014/30/EU, OJ L 96/79 of 29.3.2014)

Applied harmonised standards:

- EN 61326-1:2013

RoHS Directive (2011/65/EU, OJ L 174/88 of 1.7.2011)

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

The manufacturer compiles the technical file according to 2006/42/EC Annex II

Place and date of issue: Graz, 16 December 2025

Signed by:
E1A52CE5F1F84EF...
Alfred Freiberger
Executive Director
Business Unit Characterization

DocuSigned by:
BEA17AE406864E6...
Dr. Michael Toifl
Head of Rheometry
Business Unit Characterization

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